"It seems to me that people come with different needs to push themselves, and make they look important. That is such an important factor that historians have to determine whether a story is bigger than the truth. I would like to point out, however, that I am not like that at all. I always feel that I got more credit than I really deserved."

Severo M Ornstein – Computer Scientist at BBN

Interviewed on December 10th 2003 in Palo Alto (CA)

Born on October 13, 1930 in Pennsylvania, Philadelphia. Severo Ornstein studied at Harvard University (1951 A.B. Cum Laude). He earned a Bachelor degree in geophysics and mathematics at U.C. Berkeley and Harvard University (1952).

1953-1955: He begins his career as a geophysical expert at Gulf R&D Co. Pittsburg, Pa, doing analysis and interpretation of seismic data for oil exploration.

1955-1983: Joins the prestigious Lincoln Lab at MIT, serving in various computer-related positions in research and instruction at several universities.

1967-1976: Joins BBN (Bolt, Beranek & Newman) where he becomes one of ARPAnet key system designers. He designed all initial hardware and later created the advanced terminal handling hardware. He served as assistant director of the ARPAnet Project and held other managerial responsibilities.

1976-1983: He joined the Computer Science Laboratory at Xerox PARC where he designed many new hardware systems from music editing systems to early controllers for raster scan displays or raster printers.

1983-present: he is the Founder and chairman of Computer Professionals for Social Responsibility (CPSR).

www.hardvard.edu
www.mit.edu
www.bbn.com
www.parc.org
www.CPSR.org

Do you remember when you had your first contact with a computer?

Yes, I remember it very clearly. It was in 1953, and had to do with climbing rope. I am a mountain climber and I was working as a geophysicist for a Gulf Oil company in Pittsburg and one morning when I went to work, I saw climbing rope in the back of a car in the parking lot. I thought that it was nice that there was someone else who likes climbing, so I asked the guard whose car it was and I looked him up. That guy, who is a friend of mine to this day, had been working at MIT on a Whirlwind computer. He told me about the work he had done, and it happens that at the time I was doing interpretations on seismic records, which needs correlating between those records. A lot of what I was doing seemed something that a machine can do, so when he introduced me to a computer, one thing led to another and I suddenly found myself doing programs on the Whirlwind computer. These were the earliest days of computers and programming language was native machine language.

What was your first contact/experience with Internet or ARPANET?

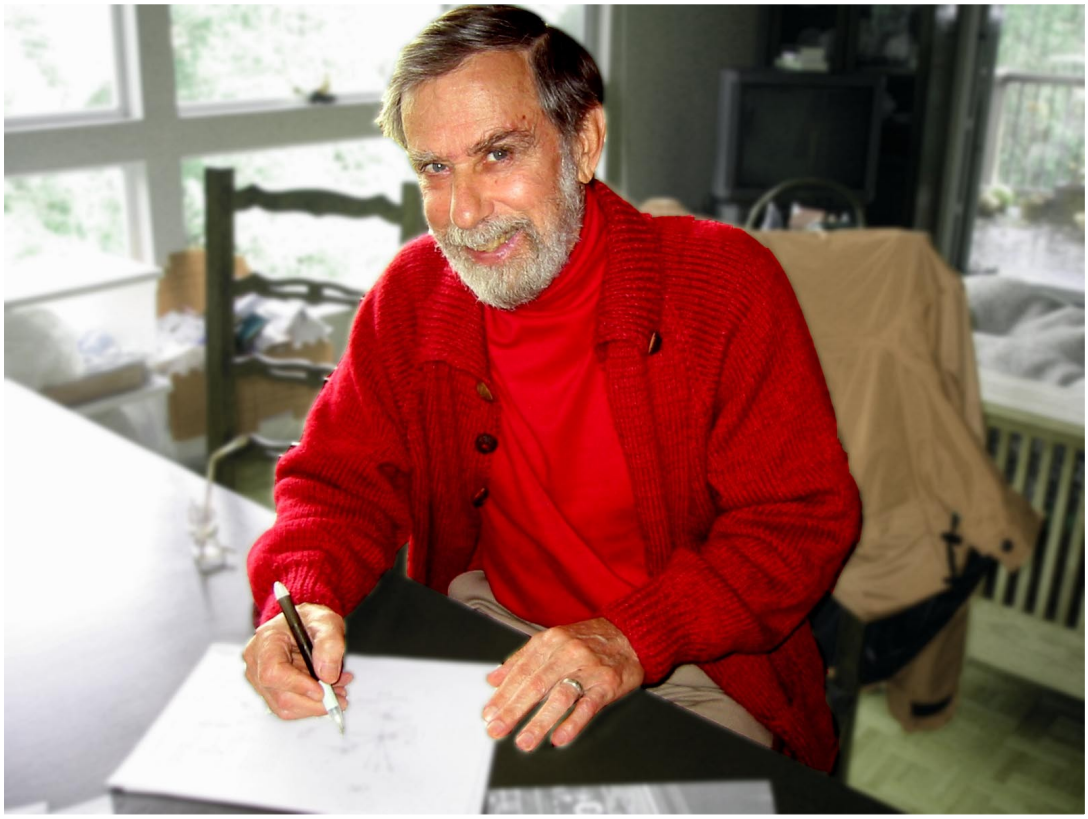
My first involvement with what became the internet was the RFP that came from ARPA that was circulated around. In 1967, I was casting about and I went to work for BBN in Boston because of Frank Heart. He was a friend and I had worked with him before. One night in early 1969, he handed me the RFP and said "why don't you look this over, see if you'd be interested in working on this". I took it home and when I came back, I said "well, looks like we could build it, all right, but I can't imagine why anybody would want such a thing."
So, that's funny now in retrospect, but it's also true in some measure. I was just an engineer; it was not a vision which I had at all. I wasn't aware of the vision that people like Bob Taylor had, and that other people had. I mean there was some justification for the thing that was valid about it that time, but as far I could see, those justifications had tremendous road blocks in the way. There was a common fear of machines because of the economy, and there was a lot of talk about connecting all of the ARPA sites, so they could share resources, programs, and so forth. But I don't think anybody envisioned what's happened at all. I thought that those visions that were stated were somewhat unrealistic, and in fact they did not come to pass for many years. By the time they came to pass, many other things had changed and we have been living in a different world entirely.

In your opinion, what are the key characteristics of Internet?

I can say that the important role it has on the world is gathering people and serving as a tool for democracy. One of the clearest examples of this is during the time of President Clinton. The public was so tired of the Republican movement to impeach the president due to his having an affair with a young woman, people were saying that we should move on, drop all of this and get on with the business of running the government. Some people in Berkeley started a website called moveon.org and it was designed specifically at that time to gather people who wanted to persuade the government to forget about the impeachment and move on. That has been the kind of usage which I hoped the Internet would provide.
So for me, the most important characteristic is the ability to provide a way for people to communicate about social issues.

What do you consider the most important milestones in the development of the network?

- 1970-71 The building of the subnet, which is the sort of basic backbone net
- 1974 The development of E-mail
- 1991 The development of the World Wide Web



How did you contribute to the development of the Internet?

The building of the subnet and making it work. It was a nice isolated job and I knew we could do that, that was very straightforward engineering.
The RFP[1] was very detailed and everything was very well spelled out, but we changed the specifications from the RFP because we thought that what was written there was not a good way to do things.
BBN was a small company and that RFP was the kind that usually was won by big companies, so we knew that our proposal must be exceptionally better than everyone else in order for us to win. It took us months to prepare the proposal and we actually designed a complete system in it.
It was about building the next set of layers up, where the hosts have to figure out how to talk to one another using that layer. If we could put it online, if we could make it pass messages, that was what everybody was desperate to have.
I watched with wonder how things evolved since then. I simply helped to build that first part, that's all. After that, I had nothing to do with the internet.

Who are some key people in the development of Internet, leaders or trendsetters?

Frank Heart was the leader of the working group at BBN
David Walden, an engineer with exceptionally good memory.
Larry Roberts is exceptionally bright and one of the few people who is able to be both a manager and a researcher. If I must point out a single person who I think really created the net, it would be him.
Wes Clark contributed a lot. I remember being in a meeting, discussing how to connect the hosts. The original idea was to connect hosts directly, which would create many redundant paths. West pointed out that these computers are different and each one of them would have to do something special to communicate with all of its neighbors. He suggested using a small device in front of each computer and letting these devices take care of communication and error correction, so each computer would only need to communicate with the device in front of it. These devices were later built and known as IMPs and later on called routers.
Bob Kahn at that time had been a specialist in signal processing at MIT. He worked together with me in testing the designs theoretically, and at that time he actually did not understand computers and was learning a lot from that experience. He tends to take more credit for what he did than he should.
Ray Tomlinson, for introducing the @ system to pinpoint a user at a particular machine when sending messages across networks.

[1] RFP: Request For Propposals. A very common way to describe a public administration needs, in order to obtain commercial propposals.

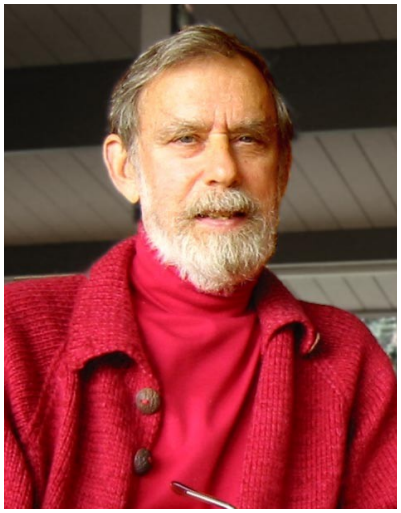
Tim Berners Lee for creating the World Wide Web
Will Crowther, was a superb machine language programmer. He built the first computer game that became the predecessor of the Dungeon and Dragons type of game.

Bob Taylor, he is not a technical person at all, but he had very good instincts about what was important to work on. He was like a general who can't fight a war by himself, but knows which guys are the right ones to have as lieutenants in his army. He assembled a very powerful army of people. He would direct people and they followed his direction even when they did not have any idea how to go that way. But, I think he rubbed people the wrong way because he was rather arrogant, and the fact that he did not actually do the work or write any paper about the work, as well as some other reasons, is why his name does not get mentioned anywhere.

Norm Abramson built the ALOHA network system in Hawaii, which was later adapted by **Bob Metcalfe** to create the Ethernet for Local Area Networks.
Vint Cerf, but he was not really important at the time I was there. I guess he grew importance over time.

Leonard Kleinrock, but we did not pay much attention to his work at the time because he was a mathematician and we were engineers.
Steve Crocker
Paul Baran
Joseph C. Licklider among others.

Can you explain two anecdotal situations ?



There was someone sitting in the middle of nowhere, and he wanted to be able to work just the way all the people who have local lines to their hosts would work, but he did not have any reason to go through the host. So, we built an IMP that we called "Many Hosts". It had the very basic parts of the host computer in it, so we could connect terminals directly into the IMPs without going through the hosts, so people like that could communicate with terminals directly to the IMPs. In fact, we called these things Terminal IMP (or TIP). These people thoughtinks that because this was a part of a big network, we were responsible whenever their line went down, and no matter how much we tried to explain that their line was not our responsibility, they kept blaming us whenever their lines were not working. So we built a system to test these lines. All of these lines were phone lines

with modems, so there was a list of phone numbers to call, to verify that the lines were working. One day the guys at control center who were watching these things saw that one line was having trouble, so they called while listening into the line. They dialed, and they heard the "tweet" sound, and suddenly there was a voice on the other end of the line saying "It's you again!!! (slamming sound)". It turns out that they had the wrong phone number, and while they thought they were calling a machine, actually they were calling a person. This kind of incident is of course common now, but that was about the first time it happened.

At BBN then, there was an IMP because we were a member of the network, but we also had the control center that was responsible for the network. We needed to put a jumper at the bottom of this IMP, and it was running in the network at the time and we didn't want to take it down. So, everybody gathered around and because I was in charge of hardware, I got down on my hands and knees and the location was right down at the bottom of the machine. I saw the pins and I had to put the jumper on very carefully, but as soon as I touched the pins, it brought the machine down. So, the people who were responsible for networking rushed in and kicked us off and put it all back up again. We realized that we didn't remember to put the jumper while the machine was down so another fellow stepped up, his name was **Dan Parker** and he was a junior guy, a student of mine. So he said "I am going to do it" and I shouted "No way". He got down on his hands and knees, and he could look at the pins, and his hand was going up there trembling. He stopped shaking, he put it on, and then started shaking again. I couldn't believe it.

What do you think about the future of Internet?

My interest in it is really in the political agenda. I worry that the use of internet will be subverted by commercial interests, and the kind of use that I expected, the one for democracy, will be suppressed.

Do you see any technological trends?

Not really. I think basically they will simply get higher speed, because once you get a high enough speed, you can do things that you couldn't even think about doing at a lower speed. There's also a trend towards artificial intelligence, but I am skeptical about it, I

believe that we gain intelligence partly by evolution, not just by information. So I really doubt that dumping the whole pool of information into a bucket will create intelligence. Sure enough, there have been some results such as a responding machine, but it is way far from the kind of artificial intelligence that everyone imagined.

ADDITIONAL READING

PAPERS & BOOKS MENTIONED / RECOMMENDED

- *Where Wizards Stay Up Late.* © 1996 by Katie Hafner and Matthew Lyon. New York Touchston Simon & Schuster. ISBN 0-684-81201-0
- *Computing In the Middle Ages. A View from the Trenches 1955-1983.* Editor: Lightning Source Inc. Severo M. Ornstein ISBN: 1403315175
- *The Dream Machine JCR Licklider and the Revolution that made Computing Personal.* © 2001 Mitchell Waldrop. Penguin Books. ISBN 0-670-89976-3